

1. A phenetic tree was constructed from data standardised as to give equal weight to all characters used. First, these data were used to calculate the average taxonomic distance (SOKAL & SNEATH, 1963) between all pairs of specimens. Then a hierarchical technique called "the unweighted pair group method using arithmetic averages" (UPGMA, SOKAL & SNEATH, 1963) was employed.

2. A principal component analysis (PCA) was performed (see BLACKITH & REYMENT, 1969) to find out whether the a priori groups represented distinct groups (taxa) or not. Furthermore, the original 26-dimensional character space was reduced to 2, 3 and 5 dimensions by using non-metric multidimensional scaling analysis (MDS, KRUSKALL, 1964). In the 3- and 5-dimensional case, the resulting structure was rotated to its principal axes by using PCA. The resulting scatter diagrammes are not included, but reference to the result of the MDS will be made where it disagrees with the PCA. For all calculations, the program package NT-SYS version II (ROHLF, KISHPAUGH & KIRK, 1974), available at the Uppsala University Data Center, was used.

TABLE 1 : Morphological characters used in the numerical analyses. All size characters are measured on a linear scale.

1. Stem indumentum	absent (1) — very dense (4)
2. Stem indumentum length of hairs	
3. Stem indumentum glandular hairs	no (1) — dense (3)
4. Stem indumentum length of glandular hairs	
5. Petiole length/lamina length of middle leaf	
6. Lamina width/length for middle leaf	
7. Angle of leaf base	45° (1) — 90° (3)
8. Bracts	Small, inconspicuous (1) — large, dominant (3)
9. Length of calyx in fruit	
10. Length of calyx at anthesis	
11. Corolla length	
12. Corolla tube length	
13. Length of upper lip	
14. Length of lower lip	
15. Stamen upper theca length	
16. Anther length	
17. Stamen length including anther	
18. Length of lower anther theca appendix	
19. Distance stamen base to base of tube	
20. Style length	
21. Seed length	
22. Capsule length	
23. Angle of capsule apex	45° (1) — 90° (4) at 15° intervals
24. Capsule indumentum	very dense (1) — glabrous (7)
25. Capsule indumentum length of hairs	
26. 1-seeded fruits	present (1) — absent (2)

RESULTS

Neither the cluster analysis nor the MDS indicate that the material can be subdivided in any simple way on the basis of morphology alone. In the cluster analysis, branches contain a mixture of specimens from different a priori groups and specimens from a given a priori group are usually spread into several branches (Fig. 5). In the principal component (PC) scatter

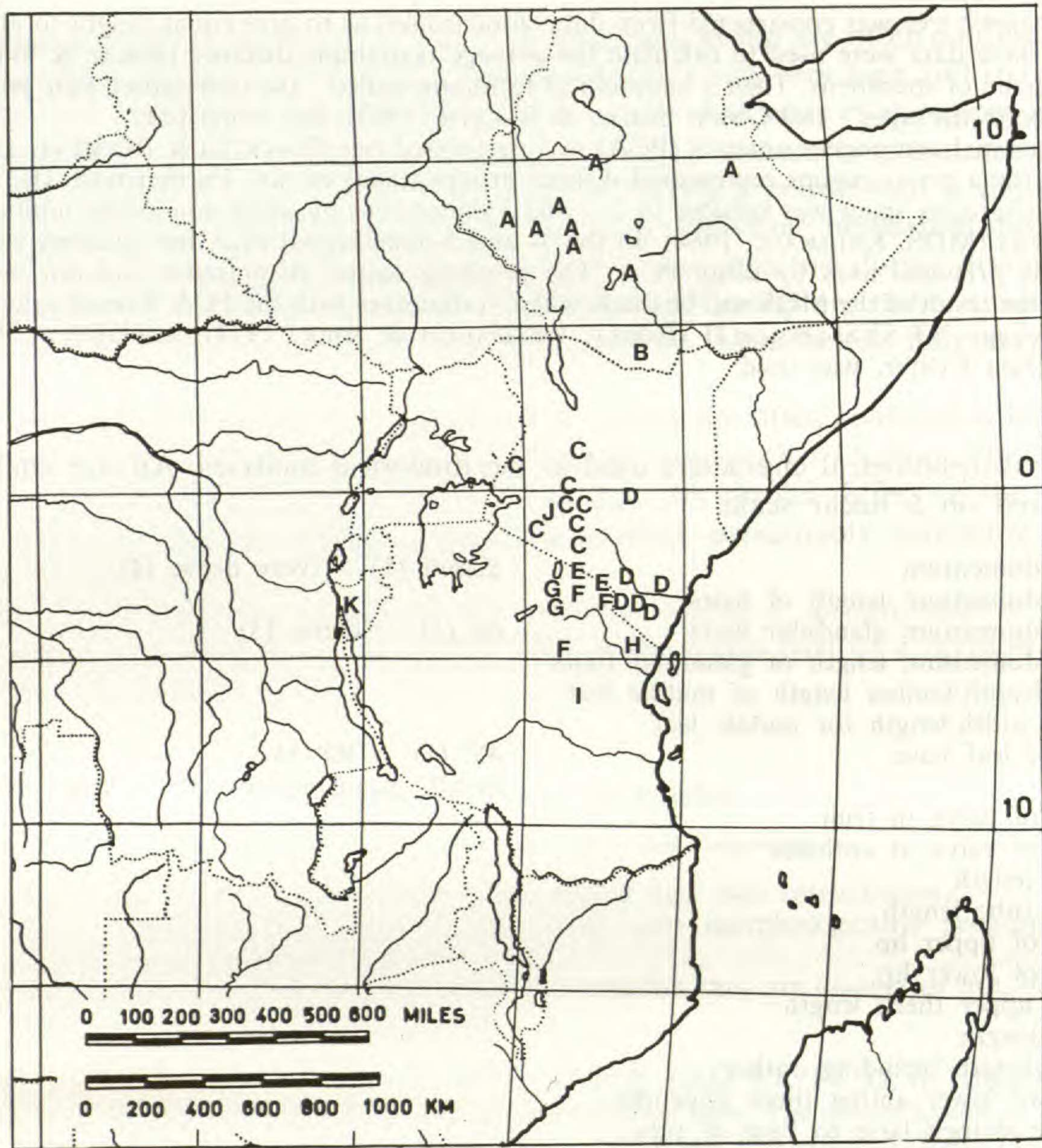


Fig. 1. — Origin of specimens used for numerical analyses. Letters refer to a priori groups. One letter may represent several collections.

diagrams (Fig. 2-4, *above*) a priori groups are linked to each other to a large extent. Still, many of them seem \pm distinct. In the PC scatter diagrams, a priori groups are largely separated along the first principal component, which is mainly based on corolla size characters. These characters are strongly correlated (Fig. 2-4, *below*) and probably contribute very much to the formation of clusters within the phenetic tree, whereby specimens that come close together are foremost similar in corolla size. For instance, group C and group H, which were rather well separated in Fig. 2, are rather closely overlapping in Fig. 4, as also applies to some extent to group A and group F. However, even if the size of the floral parts can be modified by environmental influence (see Fig. 10), size differences can by no means be disregarded. The second and third PC are based on characters other than size characters (Fig. 2-4, *below*). With an increasing number of dimensions, the result of the MDS approaches that of the PCA.

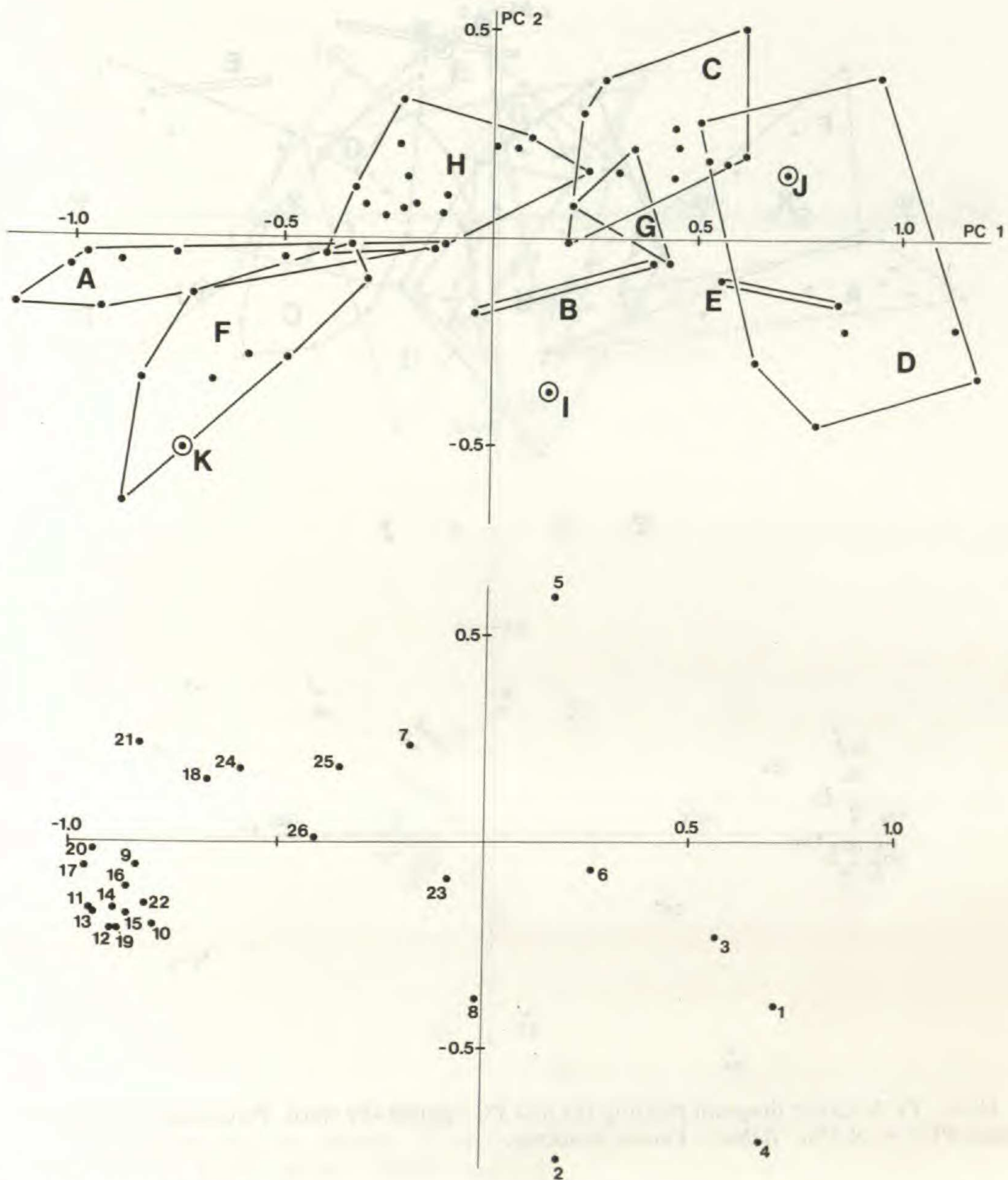


Fig. 2. — Above : PCA scatter diagram plotting the first PC against the second. Groups of specimens (as defined in Fig. 1) are surrounded by unbroken lines. Percentage of trace along PC1 = 48.9% and along PC2 = 8.9%. Below : Factor loadings for the scatter diagram given above.

Group A from the Ethiopian highlands contains subglabrous specimens with large corollas and relatively narrow leaves. It is similar to groups F and K in size characters, but separates rather well along the second and third principal components. It is treated as *J. diclipteroides* subsp. *aethiopica*.

Group B from Mega Mt. in southern Ethiopia differs from the previous group in the smaller corolla, dense indumentum, and in the proportionally broader leaves. It separates rather well in the scatter diagram based on the first two principal components and it is recognized as *J. diclipteroides* subsp. *megaensis*.

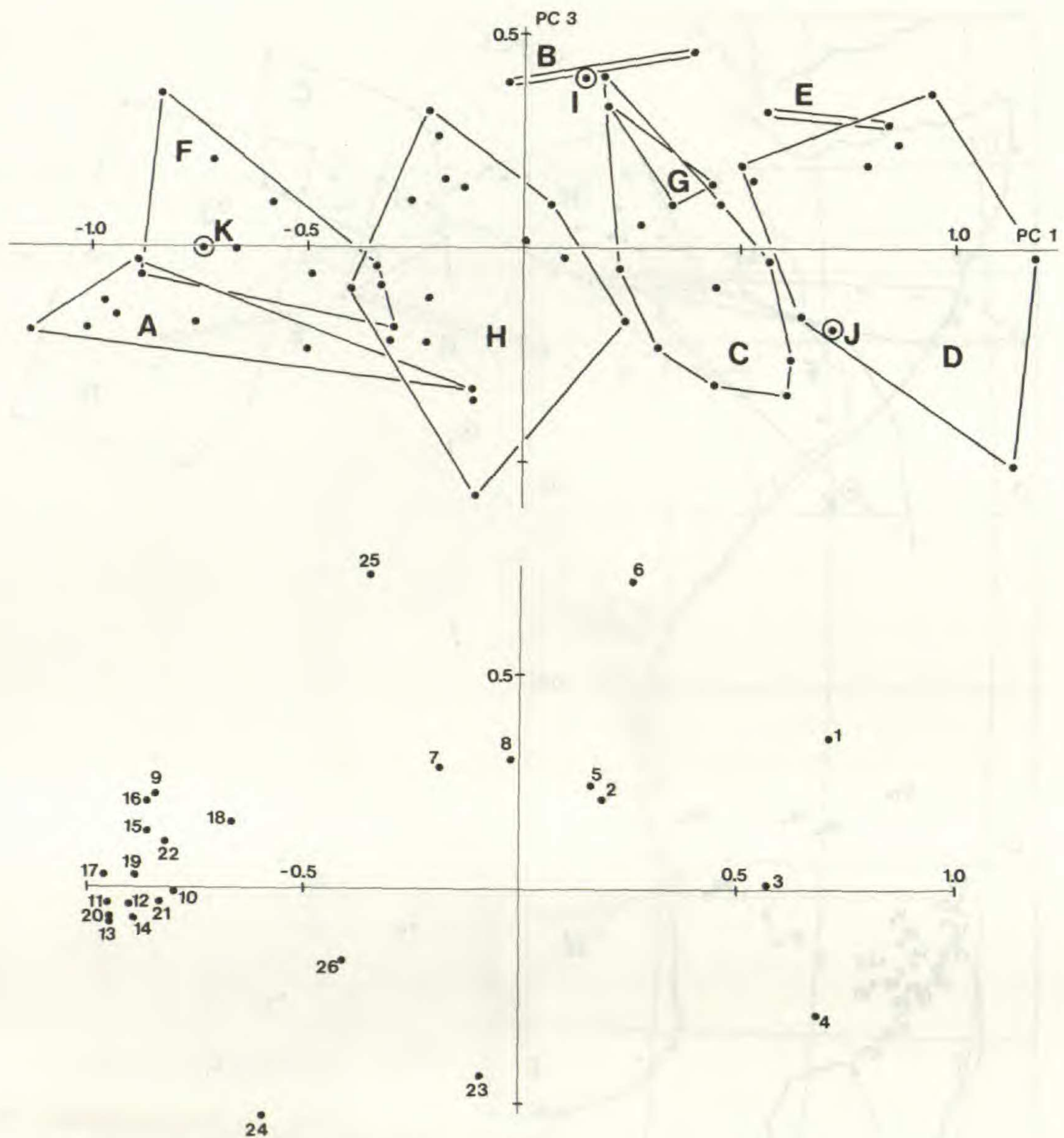


Fig. 3. — Above : PCA scatter diagram plotting the first PC against the third. Percentage of trace along PC1 = 48.9% and along PC3 = 8.4%. Below : Factor loadings.

Group C from the western Kenyan highlands is well separated from groups A and B, primarily by its smaller corolla and in being sometimes heterocarpic. Morphologically it seems less well separated from D, G, H and perhaps J. However, considering its distribution and its fairly good morphological separation from groups D and H, it deserves subspecific recognition as *J. diclipteroides* subsp. *nierensis*.

Group D containing specimens from the eastern Kenyan lowland, comes close to the previous group, but differs in the usually dense, erect indumentum mixed with glandular hairs, and in the small corolla. This is *J. diclipteroides* s. str.

Group E. Two specimens collected on the lower slopes of Mt. Meru in Tanzania fall close to group D in the PC scatter diagrams, but are kept as a more distinct group in the MDS. Their position in the phenogram seems somewhat unclear. They differ from group D in their eglandular indumentum. As they are only known from few collections and come from an area close to that of group D, it seems most appropriate to include them in that group.

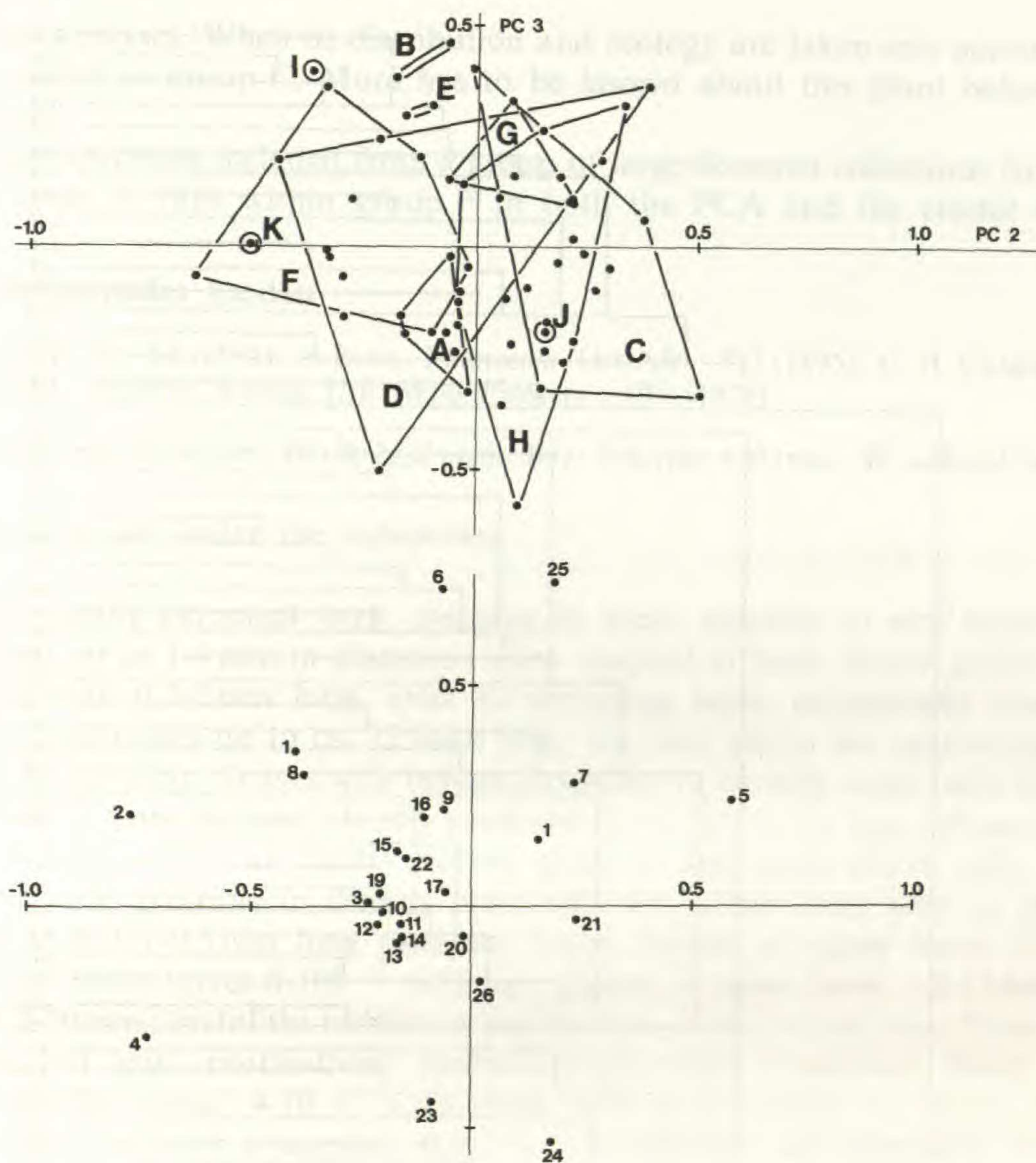


Fig. 4. — Above : PCA scatter diagram plotting the second PC against the third. Percentage of trace along PC2 = 8.9% and along PC3 = 8.4%. Below : Factor loadings.

Group F, consisting of specimens from Mt. Meru, Mt. Kilimanjaro and Kolo Mt. in Tanzania approaches group A in corolla size, but differs in the usually more dense indumentum and in the usually broader leaves, characters included in the second and third PC's. Group K seems related, see below. Group F is treated as *J. diclipteroides* subsp. *praetervisa*.

Group G contains three specimens from the Mbulu district in Tanzania. They are variable in indumentum, sometimes approaching group D in having glandular hairs, but approaching group C in corolla size. In the phenetic tree they are split between groups C and D, but come closest to group C in the PCA. They are here included in group C, but more material is needed.

Group H includes all specimens from the W. Usambara Mts. It is intermediate between groups A, F and C in the PCA, but seems distinct enough to deserve subspecific rank, *J. diclipteroides* subsp. *usambarica*.



Fig. 5. — Phenetic tree based on the distance matrix. Cophenetic correlation coefficient = 0.651. Letters refer to a priori groups and numbers to the numbers cited in the specimen lists.

I is the only specimen included from Mt. Kibariani in Tanzania. With its medium-sized corolla, densely hairy stem and broad leaves, it seems distinct from the rest of the material. It separates clearly in the PCA and is described as *J. diclipteroides* subsp. *kibarianiensis*.

J is a single specimen collected near Narok in Kenya. It comes close to groups C and D in the PCA and close to C in the cluster analysis, but is better separated in the MDS. Furthermore, it seems distinct in its thick stem and strictly erect habit, characters not included

in the numerical analyses. When its distribution and ecology are taken into account, it seems most closely related to group C. More has to be known about this plant before it can be formally named.

K is a single specimen included from a group of large-flowered collections from Burundi and adjacent areas. It falls within group F in both the PCA and the cluster analysis.

***Justicia diclipteroides* Lindau**

Bot. Jahrb. Syst. 20 : 65 (1894); in ENGL. Pflanzenw. Ost-Afr. : 373 (1895); C. B. CLARKE, Fl. Trop. Afr. 5 : 203 (1900); AGNEW, Kenya Upl. Wild Flowers : 605 (1975).

TYPES : *Hildebrandt* 2726 (syn-, B†) & 2331 (syn-, B†); *Scheffler* 420 (neo-, W, selected here; iso-, C).

For synonyms, see under the subspecies.

Annual to usually perennial herb, creeping to erect, sparsely to well branched, 0.15-4.5 mm tall. Stem up to 1-4 mm in diameter, often lignified at base, almost glabrous to very densely covered with 0.2-2 mm long, erect to spreading hairs, occasionally together with glandular hairs. Internodes up to ca. 125 mm long, the ones above the uppermost flowering nodes up to ca. 45 mm long. Leaves with lamina lanceolate to broadly ovate, with the broadest part usually 25-45 % from the base, shortly attenuate to cordate at the base, obtuse to acute or acuminate at the apex, entire or slightly crenate, green to dark green above, pale, sometimes bluish green beneath, glabrous to densely hairy with 0.1-1.2 mm long hairs at the margin, sometimes also with 0.1-0.5 mm long glandular hairs; lamina of upper leaves 5-53 × 2.5-34 mm and that of lower leaves 8-100 × 6-55 mm; petiole of upper leaves 1.5-15 mm and that of lower leaves 2-50 mm; cystoliths rodlike or slightly bent, 0.05-0.4 mm long. Flowers usually few together in leaf axils, protandrous, synflorescences rarely condensed. Bracts narrowly lanceolate to broadly ovate, 4-10 × 1.2-6.5 mm, with indumentum as leaves, sometimes lacking. Bracteoles narrowly triangular, 0.8-1.5 × 0.3-0.6 mm, inconspicuous. Calyx-lobes narrowly lanceolate to narrowly triangular, with ± distinct, white, hyaline margins, 2.3-9.5 mm long at flowering stage, up to 2.7-10 × 0.4-1.2 mm in fruit, with few to fairly numerous 0.1-0.7 mm long, erect to somewhat antrorse hairs, usually with glandular hairs in addition. Corolla magenta with darker veins at upper lip and a magenta/white pattern at lower lip near the throat or rarely white, 8.2-19.7 mm long, including a tube of 5.5-10.3 mm; upper lip 3.5-11.4 mm long; lower lip 3.8-17.2 mm long and 4.7-19.6 mm wide; width of tube opening 2.3-5.5 mm; ridges at lower lip very sharp and distinct. Stamens with the free part 3.2-8.1 mm long, fused to the corolla tube for 4.5-9 mm at the base; anther 1.5-3.2 mm long, yellow; displacement of thecae 0.4-1.2 mm and tail of lower theca 0.4-0.8 mm long. Style 5.4-11.5 mm long, equalling the stamens; stigma-lobes usually equal, 0.15-0.45 mm long. Capsule 4.3-13 × 1.7-3.1 mm, acute at an angle of ca. 30-90° at the apex, glabrous to densely pubescent with erect to somewhat retrorse 0.3-3 mm long hairs. Heteromorphic 1-seeded fruits sometimes present. Seeds 1.3-2.5 × 0.9-2 mm, tuberculate.

DISTRIBUTION : *J. diclipteroides* is known from Ethiopia, Kenya, Tanzania, Zaire, Rwanda and Burundi. — Fig. 9.

KEY TO SUBSPECIES

1. Corolla up to 12.5 mm long; 1-seeded, weakly spiny fruits sometimes present 2
- Corolla 12.5 mm long or more; all fruits 4-seeded without projections 4
2. Corolla usually with a pale area at the lower lip near the tube opening; 1-seeded fruits not present (Tanzania, W Usambara Mts. & Pare Mts.) d. subsp. *usambarica*
- Corolla usually with dark purple streaks at lower lip near the tube opening, not pale; 1-seeded fruits often present, mixed with normal 4-seeded capsules (southern Ethiopia, Kenya, north-central Tanzania) 3
3. Stem with numerous 0.3-2 mm long erect eglandular hairs, mixed with fairly numerous 0.2-0.6 mm long glandular hairs g. subsp. *diclipteroides*
- Stem with 0.2-1 mm long, erect to somewhat retrorse eglandular hairs at internodes, rarely together with 0.15 mm long glandular hairs f. subsp. *nierensis*
4. Stem almost glabrous; capsule 10 mm long or more, glabrous (Ethiopia). a. subsp. *aethiopica*
- Stem \pm hairy; capsule less than 10.5 mm long, \pm pubescent (Ethiopia, Kenya, Tanzania, Zaire, Rwanda and Burundi) 5
5. Corolla usually with a pale area at lower lip near the tube opening (Tanzania, W Usambara Mts. & Pare Mts.) d. subsp. *usambarica*
- Corolla usually with dark purple streaks at lower lip near the tube opening, not pale (Ethiopia, Kenya, Tanzania, Zaire, Rwanda and Burundi) 6
6. Corolla 16.4-18.5 mm long, stem moderately to fairly densely hairy b. subsp. *praetervisae*
- Corolla 13.6-13.9 mm long, stem \pm densely hairy 7
7. Upper lip at least twice as long as wide (Fig. 11); leaves broadly ovate (Tanzania, Mt. Kibariani) e. subsp. *kibarianiensis*
- Upper lip less than twice as long as wide (Fig. 8); leaves narrowly to broadly ovate (Ethiopia, Mega Mt.) c. subsp. *megaensis*

a. **J. diclipteroides** subsp. **aethiopica** Hedrén, *subsp. nov.* — Fig. 5.

Subspecies nova, subspeciei praetervisae similis, caule subglabro, capsula glabra distinguenda.

TYPE : Hedrén 513 (holo-, UPS; iso-, ETH, K).

Probably perennial herb with creeping to ascending stems, almost glabrous, with few, 0.2-1 mm long hairs usually restricted to the part below the nodes. Leaves with lamina lanceolate to narrowly ovate, truncate to rarely shortly attenuate at the base, obtuse or acute to acuminate at the apex. Calyx-lobes 5.5-10 mm long in fruit, \pm sparsely hairy with 0.1-0.3 mm long, somewhat antrorse hairs, often also with 0.1-0.2 mm long glandular hairs. Corolla 12.5-19.7 mm long. Stamens 6.6-8.1 mm long. Style 9-11.2 mm long. Capsule always 4-seeded, 10-13 \times 2.4-3.1 mm, glabrous.

DISTRIBUTION AND HABITAT. — Subsp. *aethiopica* is known from the Ethiopian highlands, where it grows at altitudes between 1300 and 2200 m (Fig. 9), at river-bank or in \pm montane, often secondary forest, associated with e.g. *Podocarpus*, *Trema*, *Ficus*, *Albizia*, *Olea*, *Polyscias* and *Anogeissus*.

REMARKS. — This subspecies is similar to subsp. *praetervisae*, but is usually almost glabrous. The specimen illustrated, *J. J. F. E. de Wilde* 5677, is unusually hairy.

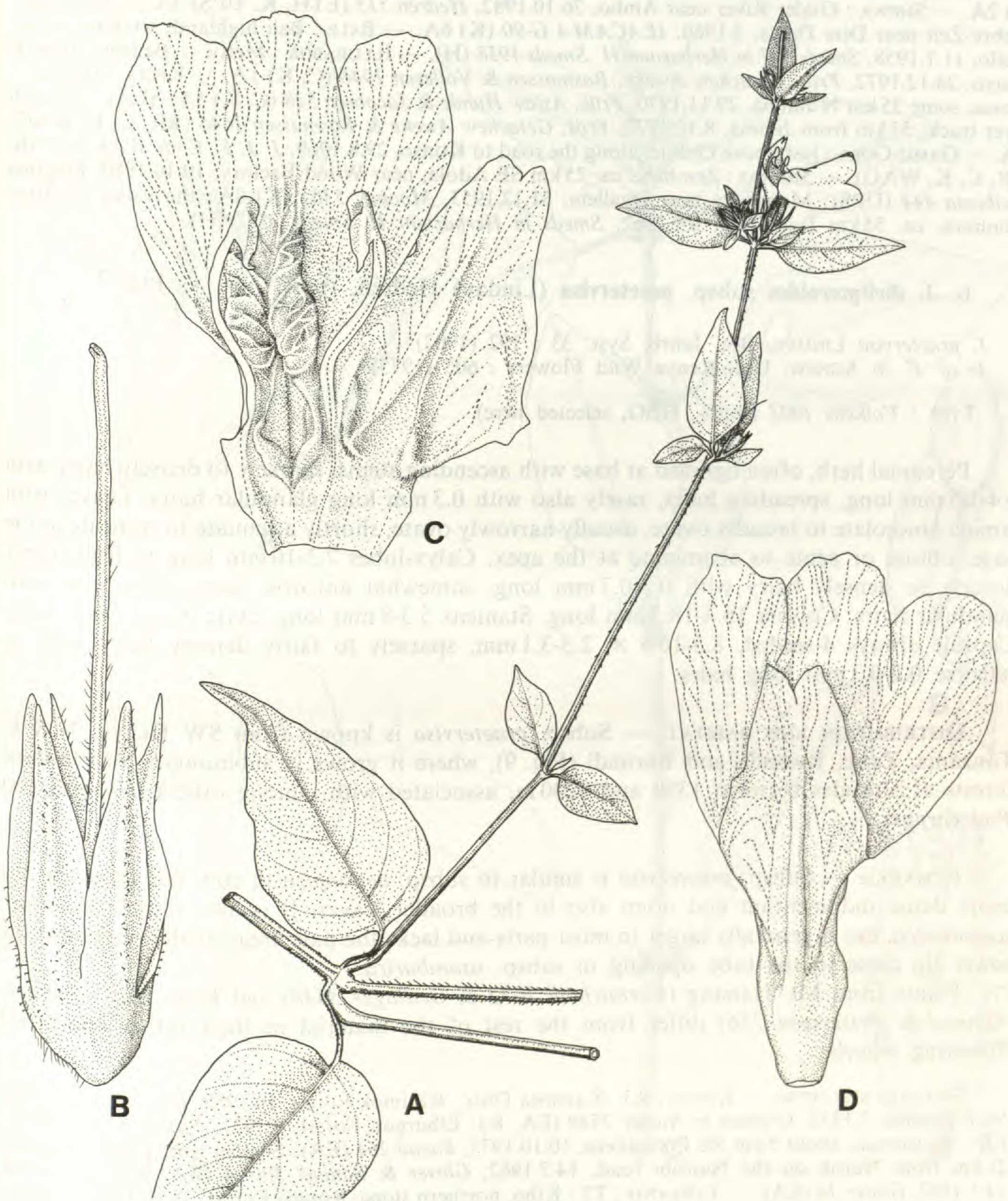


Fig. 6. — *Justicia diclipteroides* subsp. *aethiopica* Hedrén : A, habit $\times 0.6$; B, calyx with pistil $\times 6.9$; C, opened corolla $\times 3.3$; D, corolla $\times 3.3$. A from J. J. F. E. de Wilde 5677 (WAG), B-D from Hedrén 513 (UPS).

SELECTED SPECIMENS. — ETHIOPIA; WELEGA : Anfilo, near Dembidollo, 2.3.1957, *Mooney 6861* (FT, K) 2A. — SHEWA : Guder River near Ambo, 26.10.1982, *Hedrén 513* (ETH, K, UPS) 3A. — HARERGE : Debre-Zeit near Dire Dawa, 5.1960, *IEACAMA G-90* (K) 6A. — BALE : Bali highland, southern slope, Dello, 11.1.1958, *Smeds 597 in Herbarium H. Smeds 1958* (H). — ILLUBABOR : Mettu — Bedelle, 10 km E Yaiyo, 24.12.1972, *Friis, Getachew Aweke, Rasmussen & Vollesen 1946* (C, K) 1A. — KEFFA : Jimma — Cossa, some 35 km N Jimma, 29.11.1970, *Friis, Asfaw Hunde & Jacobsen 528* (C, K) 5A; Sheki — Gogeb river track, 57 km from Jimma, 8.12.1972, *Friis, Getachew Aweke & Rasmussen 1646* (BR, C, K, WAG) 7A. — GAMU-GOFA : just above Gidole, along the road to Konso, 29.8.1969, *J. J. F. E. de Wilde 5677* (B, BR, C, K, WAG). — SIDAMO : Zembaba ca. 25 km SE Adola, near Wood Factory, 19.10.1980, *Ensermu Kelbessa 444* (UPS); Manafisha near Irgallem, 31.12.1953, *Mooney 5365* (K) 8A; the valley of River Bonhora, ca. 55 km E Wondo, 6.2.1962, *Smeds in Herbarium H. Smeds 2527* (H).

b. *J. diclipteroides* subsp. *praetervisa* (Lindau) Hedrén, *comb. nov.* — Fig. 7.

- *J. praetervisa* LINDAU, Bot. Jahrb. Syst. 33 : 192 (1902).
- *J. sp. E. in* AGNEW, Upl. Kenya Wild Flowers : 605 (1975).

TYPE : *Volkens 1903* (lecto-, HBG, selected here).

Perennial herb, often lignified at base with ascending stems, sparsely to densely hairy with 0.4-1.5 mm long, spreading hairs, rarely also with 0.3 mm long glandular hairs. Leaves with lamina lanceolate to broadly ovate, usually narrowly ovate, shortly attenuate to truncate at the base, obtuse or acute to acuminate at the apex. Calyx-lobes 7.3-10 mm long in fruit, fairly densely to densely hairy with 0.3-0.7 mm long, somewhat antrorse hairs, often also with glandular hairs. Corolla 16.4-18.5 mm long. Stamens 5.3-8 mm long. Style 9.1-11.5 mm long. Capsule always 4-seeded, 8.3-10.5 × 2.3-3.1 mm, sparsely to fairly densely hairy with ± retrorse 0.2-0.3 mm long hairs.

DISTRIBUTION AND HABITAT. — Subsp. *praetervisa* is known from SW Kenya, N & C Tanzania, Zaire, Rwanda and Burundi (Fig. 9), where it grows in submontane or montane forests at altitudes between 1380 and 3200 m, associated with, among others, *Hagenia* and *Podocarpus*.

REMARKS: — Subsp. *praetervisa* is similar to subsp. *aethiopica* in size, but differs in the more dense indumentum and often also in the broader leaves. It is also similar to subsp. *usambarica*, but is generally larger in most parts and lacks the pale area usually present at the lower lip close to the tube opening in subsp. *usambarica*.

Plants from Mt. Hanang (*Carmichael 1672 & Geilinger 3448*) and Kolo Mtn. (*Hedrén, Kibuwa & Pettersson 756*) differ from the rest of the material in their rather condensed flowering whorls.

SELECTED SPECIMENS. — KENYA; K3 : Kamasia Distr., Katimok Forest, 10.1930, *Dale 2439* (BM, K); Maji Mazuri, 7.1932, *Graham in Napier 2548* (EA, K); Elburgon Forest, 9.1933, *Napier 6108* (EA). — K6 : Nguruman, about 5 km SE Entasekera, 10.10.1977, *Fayad 264* (EA); Siyabei river gorge, Oloroadi, 21 km from Narok on the Nairobi road, 14.7.1962, *Glover & Samuel 3097A* (EA, K); Loitokitok, 14.5.1962, *Gower 16* (EA). — TANZANIA; T2 : Kibo, northern slope, Rongai Forest, 25.12.1932, *Geilinger 4949* (Z) 12F; Kilimanjaro, W slope, E Lemosho Glades, 12.1.1970, *Holm & Holm 11* (K, UPS, WAG) 11F; Kilimanjaro, E slope, 29.3.1934, *Schlieben 5001* (BM, BR, G, HBG, LISC, M, P, S, Z) 10F; Kilimanjaro, Useri Forest, 4.1894, *Volkens 1903* (HBG, WU); Arusha Distr., 28.9.1932, *Burt 4113* (K)

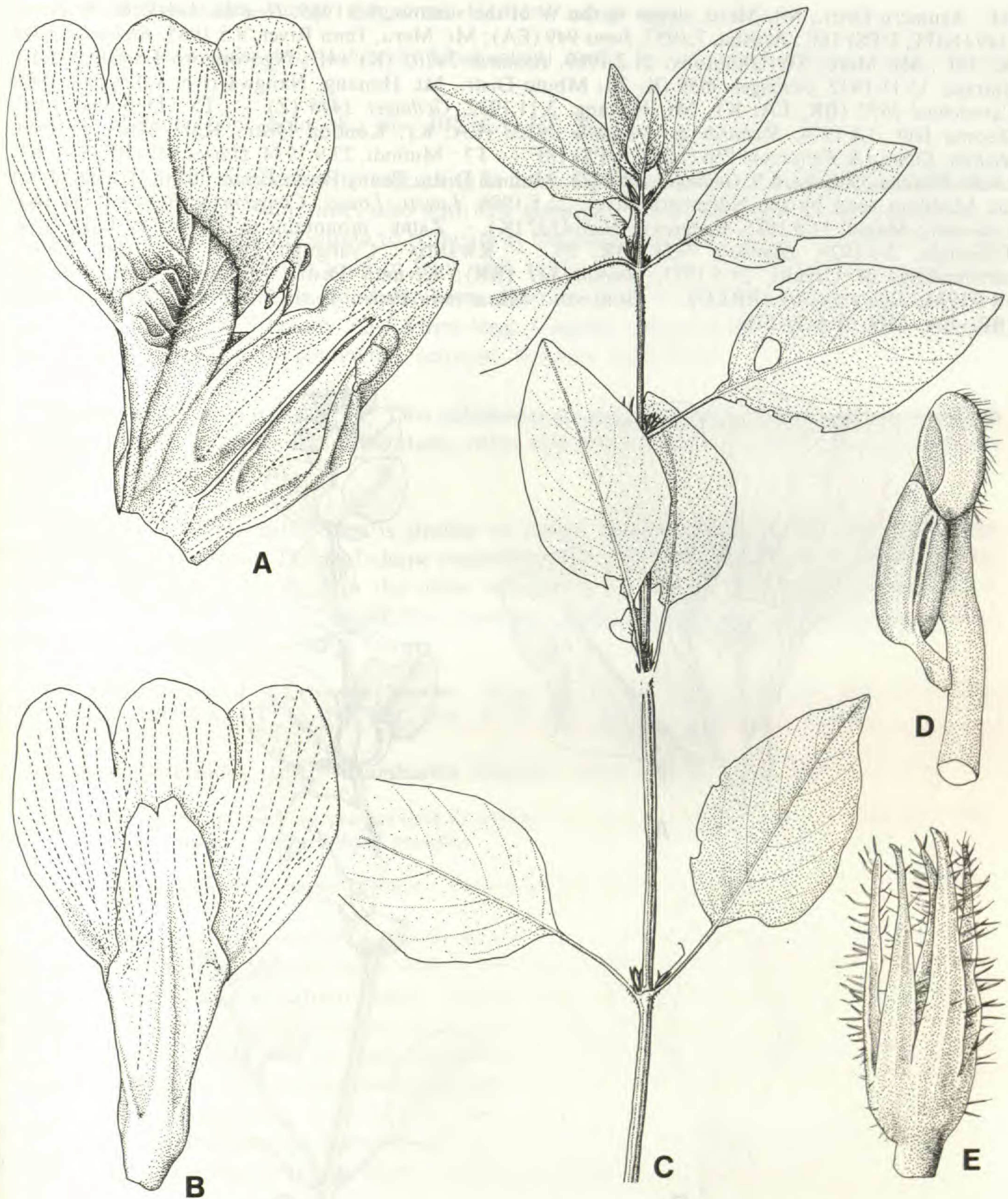


Fig. 7. — *Justicia diclipteroides* subsp. *praetervisa* (Lindau) Hedrén : A, opened corolla $\times 3.3$; B, corolla $\times 3.3$; C, habit $\times 0.6$; D, left anther $\times 14.3$; E, calyx $\times 6.9$. A, B, D from Hedrén, Leliyo & Pettersson 1149 (UPS), C from Ivens 949 (EA).

15F; Arumeru Distr., Mt. Meru, slopes to the W of the summit, 9.3.1985, *Hedrén, Lelyio & Pettersson 1149* (NHT, UPS) 16F; Arusha, 7.1957, *Ivens 949* (EA); Mt. Meru, Temi River, 9.5.1965, *Richards 20394* (K) 13F; Mt. Meru, SW Olmotony, 21.2.1969, *Richards 24105* (K) 14F; Ngorongoro Forest, N Lake Njarasa, 13.11.1932, *Geilinger 3689* (K, Z); Mbulu Distr., Mt. Hanang, Nangwa river valley, 5.6.1969, *Carmichael 1672* (BR, EA, K); Mt. Hanang, 3.11.1932, *Geilinger 3448* (Z). — T5 : Dodoma Distr., Disoma Hill, 1.4.1974, *Richards & Arasululu 29123* (EA, K); Kondoa Distr., Kolo Mtn., 9.3.1985, *Hedrén, Kibuwa & Pettersson 756* (NHT, UPS) 18F. — T7 : Mufindi, 27.9.1934, *Davies 949* (BR, EA, K); Uhehe Plateau, Dabaga, 6.9, *Geilinger 1964* (Z); Mufindi Distr., Penny Penns Farm, 30 km W Mafinga on the Madibira road by the Ndembera River, 21.5.1986, *Lovett, Lovett, Congdon & Bidgood 741* (K); Luhomero Massif, 11.8.1985, *Rodgers & Hall 4322* (K). — ZAIRE : mountains to the west of Lake Kivu, Tshibinda, 2-3.1929, *Humbert 7358* (BR, P). — RWANDA : Cyangugu Distr., Nyungwe Forest, surroundings of Uryititi, 21.5.1971, *Bouxin 841* (BR); Kivumu Distr., Mukura Forest, Rukoko, 18.8.1984, *Lejoly 84/509* (BRLU). — BURUNDI : Muramwya Prov., Teza, 21.6.1981, *Reekmans 10713* (BR, EA, MO, WAG) 17K.

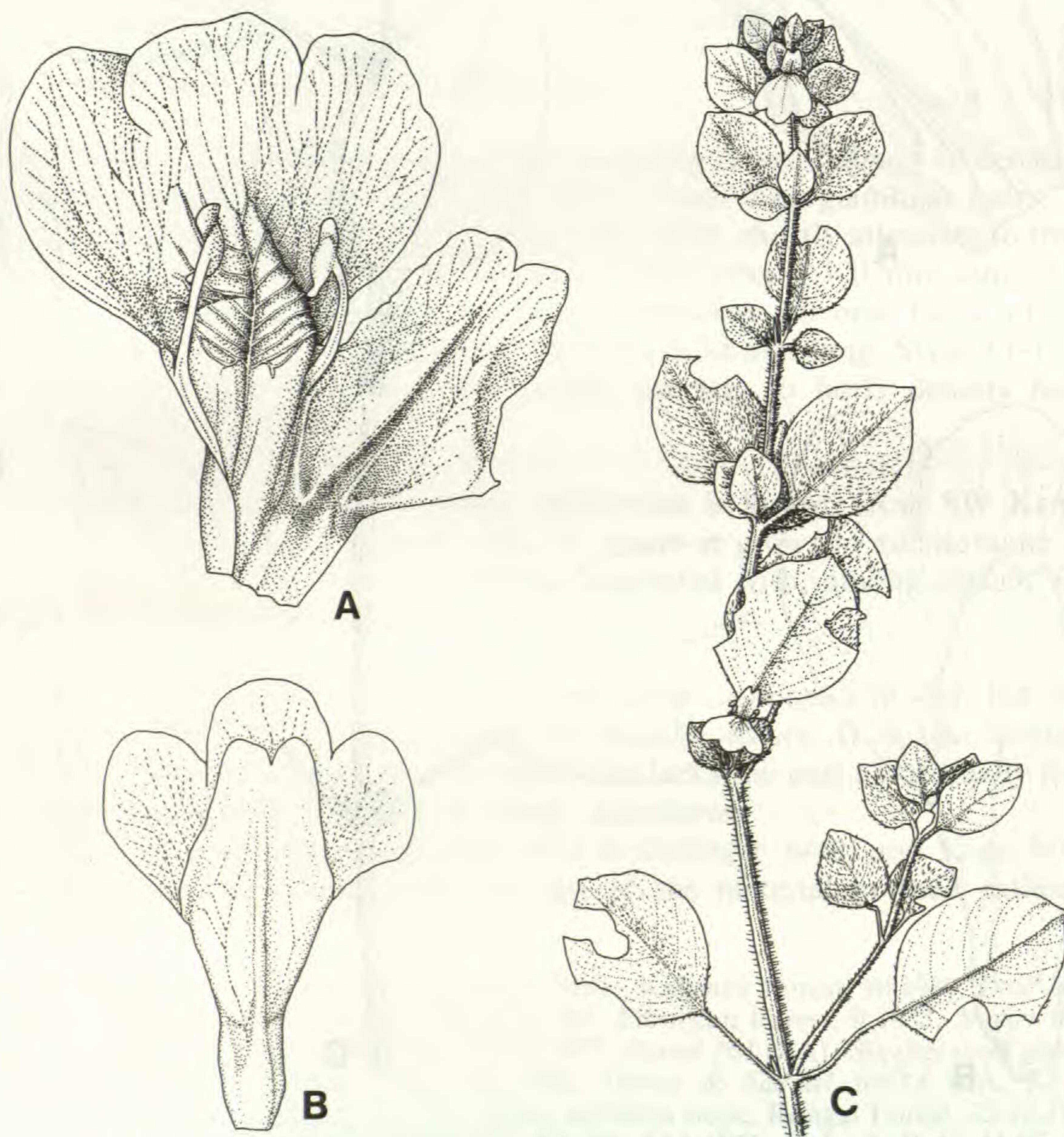


Fig. 8. — *Justicia diclipteroides* subsp. *megaensis* Hedrén : A, opened corolla $\times 3.3$; B, corolla $\times 3.3$; C, habit $\times 0.6$.
A from *Gillett 14309* (K), B from *Mooney 9840* (WAG) and C from *Gillett 14309* (EA).

c. **J. diclipteroides** subsp. **megaensis** Hedrén, *subsp. nov.* — Fig. 8.

Subspecies nova, foliis latis, subspeciei kibarianiensi similis, sed ab ea labio supero corollae latiore differt.

TYPE : Gillett 14309 (holo-, K; iso-, BR, EA, FT, W).

Probably perennial herb with ascending to erect, lignified stems, \pm densely hairy with 0.9-1 mm long, erect hairs, sometimes also with few glandular hairs. Leaves with lamina narrowly to broadly ovate, shortly attenuate to truncate at the base, obtuse or acute to acuminate at the apex. Calyx-lobes ca. 7.5 mm long in fruit with fairly numerous, 0.5-0.6 mm long, somewhat antrorse hairs, together with glandular hairs. Corolla 13.6-13.8 mm long; upper lip less than twice as long as wide. Stamens 5.5-5.8 mm long. Capsule always 4-seeded, ca. 7.8 \times 2.5 mm, rather densely hairy with somewhat retrorse, 0.3 mm long hairs.

DISTRIBUTION AND HABITAT. — This subspecies is only known from Mega Mt. in southern Ethiopia (Fig. 9). It grows in submontane, often degraded *Juniperus* communities at altitudes between 1950 and 2200 m.

REMARKS. — This subspecies is similar to subsp. *praetervisae* in corolla size and in the indumentum of the stem. The leaf-shape resembles that of subsp. *kibarianiensis*. The upper lip of the corolla is broader than in the other subspecies and in this character it resembles *J. afromontana* Hedrén, from which it differs, however, in the broad leaves with long petioles and in the not condensed flowering whorls.

SPECIMENS EXAMINED. — ETHIOPIA; SIDAMO : Mega Mt., 7.9.1953, Bally 9135 (K); *ibid.*, 17.11.1952, Gillett 14309 (BR, EA, FT, K, W) 39B; *ibid.*, 23.10.1962, Mooney 9840 (WAG) 40B.

d. **J. diclipteroides** subsp. **usambarica** Hedrén, *subsp. nov.* — Fig. 10.

Subspecies nova, subspeciebus praetervisae et nierensi similis, quoad amplitudinem corollae inter illas, macula alba labio inferno prope tubum praedito.

TYPE : Hedrén, Borhidi, Sebsebe Demissew, Iversen, Mziray & Poós 84831 (holo-, UPS; iso-, K, NHT, VBI).

Annual to usually perennial herb with decumbent to ascending stems often lignified at the base, sparsely to rather densely hairy with 0.3-0.7 mm long, erect to retrorse hairs, rarely also with 0.2-0.3 mm long glandular hairs. Leaves with lamina lanceolate to ovate, shortly attenuate to cordate, usually truncate at the base, obtuse to acute at the apex. Calyx-lobes 6-9 mm long in fruit with few to fairly numerous 0.2-0.4 mm long, somewhat antrorse hairs, sometimes also with 0.2 mm long glandular hairs. Corolla usually with a pale area at the lower lip near the tube opening, (9.5-)12.9-16.7 mm long. Stamens 4.6-6.9 mm long. Style 8.4-11.2 mm long. Capsule always 4-seeded, (5.1-)6.2-9 \times 2-3 mm with few to fairly numerous 0.2-0.3 mm long, somewhat retrorse hairs, usually confined to the upper part.

DISTRIBUTION AND HABITAT. — Subsp. *usambarica* is restricted to the W Usambara Mts. and the adjacent S Pare Mts. in Tanzania (Fig. 9), where it grows in forest clearings, secondary bushland and plantations, etc., at altitudes between 1300 and 2310 m.

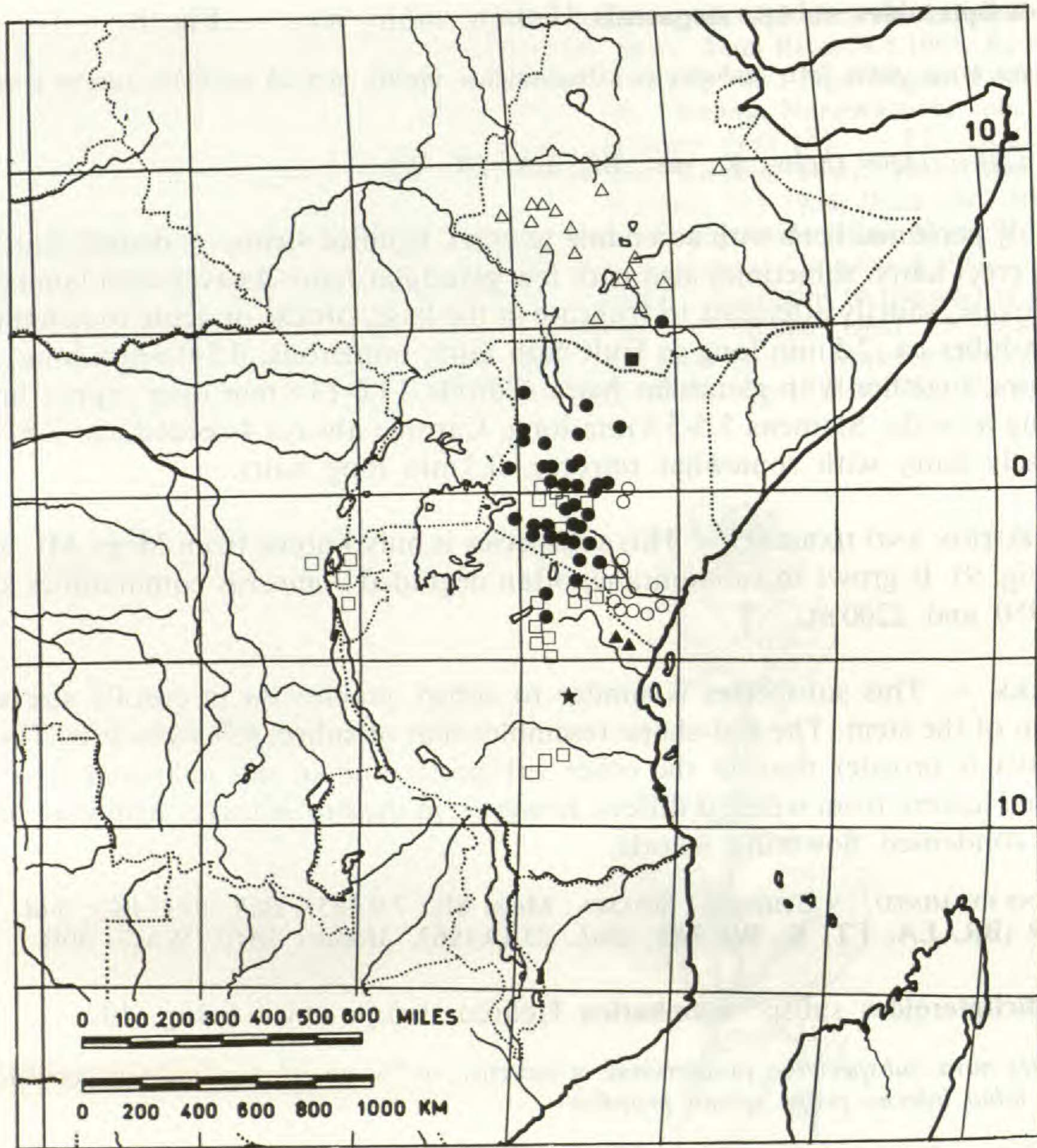


Fig. 9. — Distribution of *Justicia diclipteroides* subsp. *aethiopica* (open triangles), subsp. *megaensis* (filled square), subsp. *nierensis* (dots), subsp. *diclipteroides* (circles), subsp. *praetervisa* (open squares), subsp. *usambarica* (filled triangles) and subsp. *kibarianiensis* (star). One symbol may represent several collections.

REMARKS. — This subspecies is similar to subsp. *praetervisa*, but has a smaller corolla with a pale area at the lower lip near the tube opening. It approaches subsp. *nierensis* in corolla size, but this again lacks the pale area of the lower lip and is also often found with 1-seeded, weakly spiny fruits.

The variation in corolla size within subsp. *usambarica* seems to be largely environmentally conditioned, plants growing exposed being smaller with smaller corollas (Fig. 10A) and capsules. *Verdcourt & Greenway 335* is extreme in this respect.

SELECTED SPECIMENS. — TANZANIA; T3; South Pare Mts. : Suji, 1.3.1915, *Peter 60124, Exkursion O.III.66 (K)*. — West Usambara Mts. : Magamba, 18.7.1954, *Faulkner 1464 (BR, K, S) 22H*; Magamba — Mkuzi, 17.1.1970, *Archbold 1191 (DSM, K) 26H*; Mkuzi, 13.4.1953, *Drummond & Hemsley 2100 (BR,*

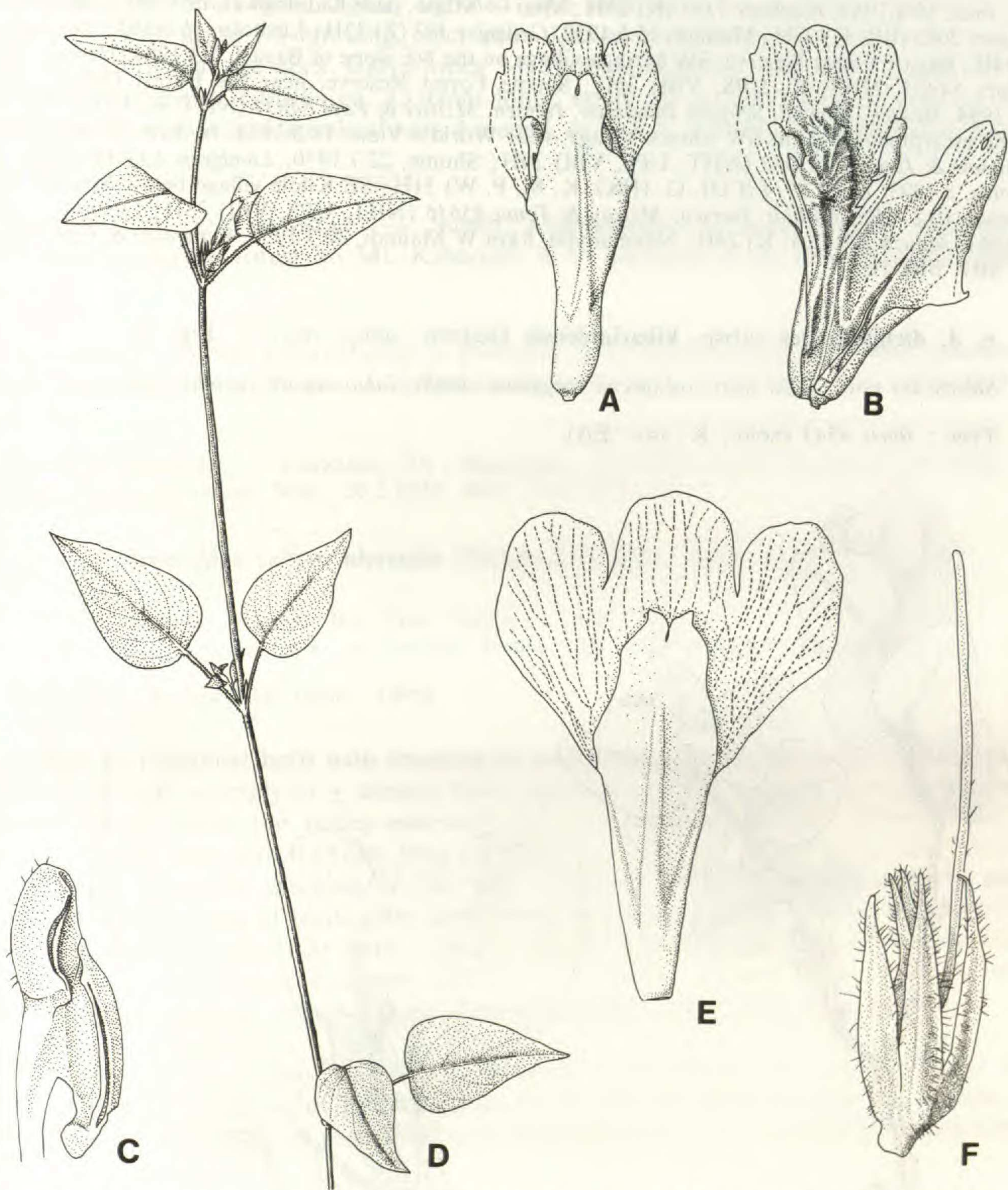


Fig. 10. — *Justicia diclipteroides* subsp. *usambarica* Hedrén : A, corolla $\times 3.3$; B, opened corolla $\times 3.3$; C, left anther $\times 14.3$; D, habit $\times 0.6$; E, corolla $\times 3.3$; F, calyx with pistil $\times 6.9$. A, B, E, F from Hedrén, Mziray & Poós 84425 (UPS, A & B from original collection, E corolla from plant grown in greenhouse at Uppsala Botanical Garden), C from Hedrén et al. 84831 (UPS) and D from Mgaza 399 (EA).

EA, K, LISC, S) 20H; *ibid.*, 7.7.1932, *Geilinger* 729 (K, Z) 32H; *ibid.*, 8.7.1950, *Williams* 45 (EA, K) 23H; *ibid.*, 10.4.1953, *Faulkner* 1151 (K) 25H; Mtai — Mlalo, near Kidologwai, 19.5.1953, *Drummond & Hemsley* 2665 (BR, K) 27H; Malindi, 15.6.1932, *Geilinger* 307 (Z) 33H; Lushoto, 16.6.1932, *Geilinger* 391 (Z) 34H; Baga I Forest Reserve, SW Mzinga village on the NE slope of Baga I, 2.3.1984, *Hedrén, Mziray & Poós* 84425 (NHT, K, UPS, VBI) 30H; Shume Forest Reserve, near the Forest Officer's house, 13.3.1984, *Hedrén, Borhidi, Sebsebe Demissew, Iversen, Mziray & Poós* 84831 (NHT, K, UPS, VBI) 35H; Shume escarpment, 2-3 km SW Shume village, near World's View, 18.3.1984, *Hedrén, Borhidi, Sebsebe Demissew & Iversen* 841072 (NHT, UPS, VBI) 29H; Shume, 22.7.1970, *Lundgren* 1 (UPS) 21H; Kwa Mshuza, 8.1893, *Holst* 8914 (COI, G, HBG, K, M, P, W) 31H; SE Kilole village below Mtumbi Forest Reserve, 10.2.1985, *Borhidi, Iversen, Mziray & Temu* 85616 (NHT, UPS, VBI) 28H; Lushoto — Gare, 2.6.1961, *Mgaza* 399 (EA, K) 24H; Ndamanyilu, 8 km W Malindi, 30.7.1950, *Verdcourt & Greenway* 335 (K, MO, SRGH).

e. *J. diclipteroides* subsp. *kibarianiensis* Hedrén, *subsp. nov.* — Fig. 11.

Subspecies nova, foliis latis, subspeciei megaensi similis, labio supero corollae angustiore distincta.

TYPE : *Burt* 4543 (holo-, K; iso-, EA).



Fig. 11. — *Justicia diclipteroides* subsp. *kibarianiensis* Hedrén : A, habit $\times 0.6$; B, opened corolla $\times 3.3$; C, corolla $\times 3.3$. A from *Hornby & Hornby* 497 (K), B, C from *Burt* 4543 (K).

Probably perennial herb, slightly lignified with suberect to erect stems, densely to very densely hairy with up to 1.5 mm long, erect hairs. Leaves with lamina broadly ovate, truncate at the base, obtuse at the apex. Calyx-lobes 5-6.2 mm at anthesis, with fairly numerous 0.5-1 mm long erect hairs. Corolla ca. 13.9 mm long; upper lip at least twice as long as wide. Stamens ca. 5.5 mm long. Capsule always 4-seeded, ca. 6.8 × 2.1 mm with rather few, 0.4 mm long hairs at the apex.

DISTRIBUTION AND HABITAT. — Subsp. *kibarianiensis* is known from margins of submontane evergreen forest on Mt. Kibariani in C Tanzania at an altitude of ca. 1800 m (Fig. 9).

REMARKS. — Subsp. *kibarianiensis* is probably most closely related to subsp. *praetervisa* which it resembles in corolla size. It differs in the more hairy suberect to erect stems and the broad leaves.

SPECIMENS EXAMINED. — TANZANIA; T5 : Mpwapwa, 27.2.1933, *Hornby & Hornby* 497 (EA, K); Mpwapwa Distr., Kibariani Mtn., 26.2.1933, *Burt* 4543 (EA, K).

f. ***J. diclipteroides*** subsp. ***nierensis*** (Mildbr.) Hedrén, *comb. nov.* — Fig. 12.

- *J. nierensis* MILDBR., Notizbl. Bot. Gart. Berlin 9 : 502 (1926).
- *J. diclipteroides* "upland form" in AGNEW, Kenya Upl. Wild Flowers : 605 (1975).

TYPE : *Fries & Fries* 200 (holo-, UPS).

Annual to perennial herb with creeping to ascending, rarely erect stems that are often lignified at the base, sparsely to ± densely hairy, especially below the nodes, with up to 1.5 mm long erect hairs below the nodes and with 0.2-1 mm long, somewhat retrorse hairs at internodes, rarely also with 0.15 mm long glandular hairs. Leaves with lamina lanceolate to ovate, cordate to shortly attenuate at the base, obtuse to obtusely acuminate at the apex. Calyx-lobes 5-8 mm long in fruit, with fairly numerous 0.2-0.5 mm long, somewhat antrorse hairs, often also with glandular hairs. Corolla 9.8-12.5 mm long. Stamens 3.5-4.8 mm long. Style 6.1-8.9 mm long. 4-seeded capsule 5.7-7.8 × 1.9-2.6 mm, sparsely to densely hairy with 0.2-0.3 mm long, erect to retrorse hairs, 1-seeded weakly spiny fruit often present.

DISTRIBUTION AND HABITAT. — Subsp. *nierensis* is distributed over upland Kenya and adjacent parts of Tanzania and Ethiopia (Fig. 9), at altitudes between 1000 and 2400 m, in forest, grassland, etc., often at roadsides or in disturbed sites. It is associated with e.g. *Olea*, *Calodendron* and *Helinus*.

REMARKS. — This subspecies is rather uniform throughout upland Kenya. In stem indumentum and habitat preferences it is usually distinct from subsp. *diclipteroides* which has stems with long, erect hairs intermixed with shorter, glandular hairs and is confined to drier lowland areas of eastern Kenya and northern Tanzania. From northern Tanzania there are some collections that in their indumentum seem to connect subsp. *nierensis* with subsp. *diclipteroides*, i.e. *Richards* 25530, *Greenway & Kanuri* 11322 & 11886.

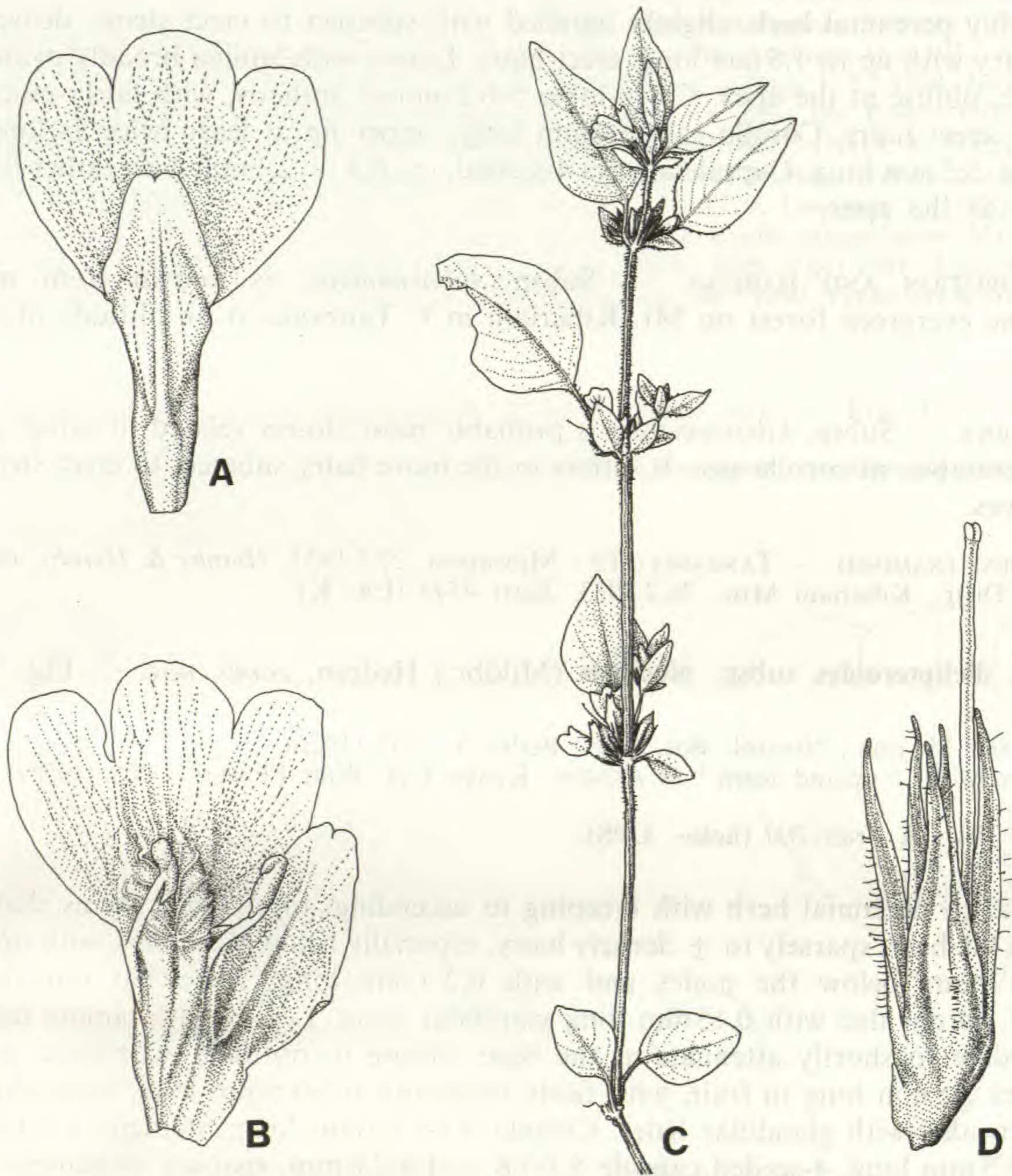


Fig. 12. — *Justicia diclipteroides* subsp. *nierensis* (Mildbr.) Hedrén : A, corolla $\times 3.3$; B, opened corolla $\times 3.3$; C, habit $\times 0.6$; D, calyx with pistil $\times 6.9$. A, B, D from *Karlström 400* (UPS cult.), C from *van Someren 5* (EA).

SELECTED SPECIMENS. — ETHIOPIA; SIDAMO : Bitata, 20 km from Negele on road to Kebre Menghist (Adola), 24.5.1983, *Gilbert, Ensermu Kelbessa & Vollesen 7802* (K). — KENYA; K1 : Lerogi Forest on Karisia Hills at top of pass between Barsaloi and Maralal, 22.11.1977, *Carter & Stannard 609* (K); Marsabit Distr., Marsabit Forest, 9.8.1968, *Faden 68/545* (K); Maralal, 4.9.1963, *Mackinnon 5* (K) 50C. — K2 : Moruassigar, 14.2.1965, *Newbould 7089* (EA). — K3 : Mt. Elgon, 12.6.1938, *Andersen 261* (S) 46C; Aberdares, 5.8.1914, *Battiscombe 855* (K) 47C; Baringo Distr., near Kabarsero, 1.9.1975, *Bonnefille & Riollet 3* (EA); Laikipia Distr., ca. 50 km N Rumuruti, near Colchecio Lodge, 5.11.1978, *Hepper & Jaeger 6619* (EA, K) 54C. — K4 : Mweiga by Nyeri, 23.4.1967, *Agnew & Agnew 9153* (MO) 55C; Nieri Forest, 21.12.1921, *Fries & Fries 200* (UPS); Nairobi, 4.12.1952, *Kanure in EAH 10271* (K) 51C; Nairobi, 15.5.1956, *Verdcourt 1488* (BR, K, MO) 52C; Nairobi, Kenya Science Teachers College, 12.1.1971, *Karlström 400* (GBG, UPS cult.); near Nairobi, 8.1903, *Whyte s.n.* (K) 53C; Karen, 8.1973, *van Someren*

5 (EA); Machakos Distr., S end Mua Hills, 2.2.1969, *Napper 1848* (BR, K); Machakos Distr., Emali — Makueni, Muoni drift, 26.2.1969, *Napper 1899* (K). — K6 : Narok Distr., Olosendo Area, 19.6.1961, *Glomer, Gwynne, Samuel & Tucker 1827* (BR, K); Narok Distr., Masai Mara Game Reserve, Talek Mara, 20.3.1973, *Jonsson 635* (UPS) 49C; Kajiado Distr., Nairobi — Magadi road, km 40, 19.2.1969, *Napper, Greenway & Kanuri 1875* (BR, K, P) 48C. — TANZANIA; T2 : Longido Mt, 25.10.1976, *Peterson 209* (EA); Masai Distr., Engaruka road, gorge and river below the escarpment, 25.2.1970, *Richards 25530* (K) 59G; Mbulu Distr., Lake Manyara Nat. Park, Endabash River, 6.3.1964, *Greenway & Kanuri 11322* (K) 57G; *ibid.*, Chem Chem River, 22.6.1965, *Greenway & Kanuri 11886* (BR, EA, K) 58G.

Subsp. aff. subsp. *nierensis* : KENYA; K6 : Oleikatorror Escarpment, 32 km from Narok on the Nairobi road, 14.7.1962, *Glover & Samuel 3136* (K) 69J.

g. ***J. diclipteroides*** Lindau subsp. ***diclipteroides***. — Fig. 13.

— *J. taylori* S. MOORE, J. Bot. Lond. 39 : 303 (1901). Type : *Taylor s.n.*, 1888 (holo-, BM).

Annual to perennial, ascending to erect herb, often with \pm lignified stems, \pm densely hairy with usually erect, 0.3-2 mm long hairs mixed with 0.2-0.6 mm long glandular hairs.

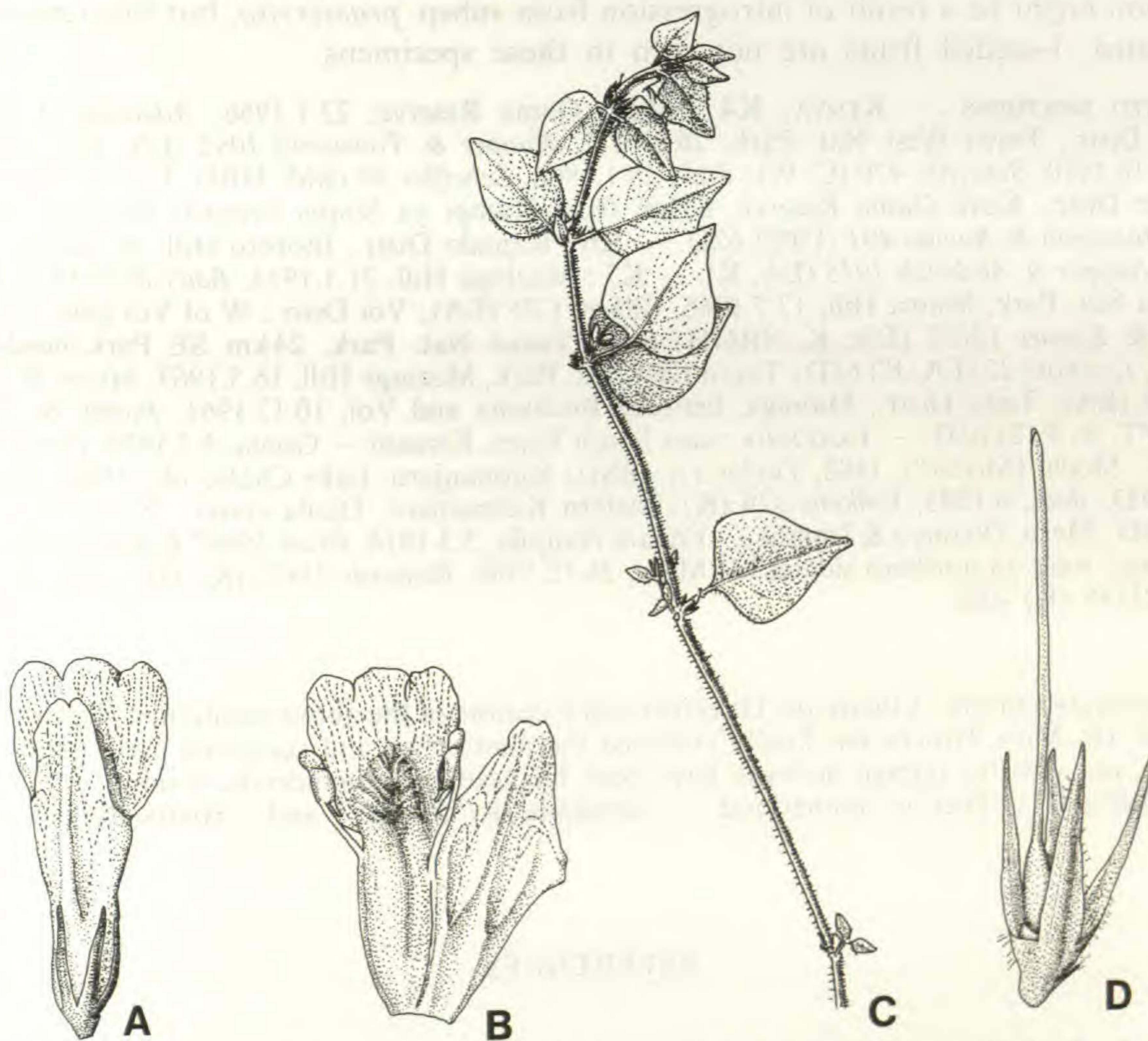


Fig. 13. — ***Justicia diclipteroides*** subsp. ***diclipteroides*** : A, flower $\times 3.3$; B, opened corolla $\times 3.3$; C, habit $\times 0.6$; D, calyx with pistil; one calyx-lobe detached $\times 6.9$. A, B, D from *Bally 8618* (K), C from *Moore & Sheldrick TNP/E/143* (EA).

Leaves with lamina narrowly ovate to ovate, shortly attenuate to cordate, usually truncate at the base, acute to obtuse at the apex. Calyx-lobes 2.7-7 mm long in fruit, \pm densely hairy with 0.2-0.6 mm long, erect hairs, usually also with 0.2-0.5 mm long glandular hairs. Corolla 8.2-11.5 mm long. Stamens 3.2-4.5 mm long. Style 5.4-7.9 mm long. 4-seeded capsule 4.5-9 \times 1.7-2.6 mm, usually densely hairy with 0.1-0.3 mm long, somewhat retrorse hairs; 1-seeded, weakly spiny fruits often present.

DISTRIBUTION AND HABITAT. — This subspecies is distributed over drier areas of Kenya and northern Tanzania (Fig. 9), at altitudes between 250 and 1650 m, and is associated with e.g. *Euphorbia*, *Boscia*, *Commiphora*, *Combretum*, *Terminalia*, *Strychnos*, *Acacia* and *Lanea* in dry forest and bushland, or on rocky outcrops, etc.

REMARKS. — Subsp. *diclipteroides* is similar to subsp. *nierensis*, but differs in the type of indumentum of the stem (see also under subsp. *nierensis*). Some densely hairy, small-flowered, but eglandular plants from the lower slopes of Mt. Meru in Tanzania (*Richards 23478* & *23516*, *Peter 59947*) are here also included in subsp. *diclipteroides*. Their character combination might be a result of introgression from subsp. *praetervisa*, but this remains to be demonstrated. 1-seeded fruits are not seen in these specimens.

SELECTED SPECIMENS. — KENYA; K4 : Meru Game Reserve, 22.1.1966, *Adamson 4* (EA, K); Machakos Distr., Tsavo West Nat. Park, 26.2.1977, *Hooper & Townsend 1062* (EA, K); Ukambani, Kibwesi, 7.10.1910, *Scheffler 420* (C, W); *ibid.*, 28.1.1906, *Scheffler 88* (BM, HBG, K, P) 67D. — K4/7 : Tana River Distr., Kora Game Reserve, 63 km from Kampi ya Simba towards Maringi, 30.5.1983, *Mungai, Mutangah & Rucina 401* (UPS) 62D. — K6 : Kajiado Distr., Iltoroto Hill, SE Sultan Hamud, 26.2.1969, *Napper & Abdallah 1915* (EA, K). — K7 : Mazinga Hill, 31.1.1953, *Bally 8618* (EA, K) 64D; Tsavo West Nat. Park, Murca Hill, 17.7.1966, *Gilbert C25* (EA); Voi Distr., W of Voi gate, 19.12.1966, *Greenway & Kanuri 12782* (EA, K, SRGH) 66D; Tsavo Nat. Park, 24 km SE Park headquarters, 26.11.1968, *Lenthold 22* (EA, K) 65D; Tsavo East Nat. Park, Mazinge Hill, 16.5.1963, *Moore & Sheldrick TNP/E/143* (EA); Taita Distr., Maunga, between Buchuma and Voi, 10.12.1961, *Polhill & Paulo 943* (BR, EA, FT, K, P, S) 63D. — TANZANIA : east South Pares, Kisuani — Gonja, 4.2.1930, *Greenway 2128* (K). — T2 : Mochi (Moshi?), 1888, *Taylor s.n.* (BM); Kilimanjaro, Lake Chala, 14.7.1968, *Bigger 1993* (EA, K) 61D; *ibid.*, 6.1893, *Volkens 319* (K); eastern Kilimanjaro, Djalla crater, 18.12.1932, *Geilinger 4778* (Z) 60D; Meru, Olvonyo & Isamba — Engare Nanjuki, 5.3.1914, *Peter 59947 Exkursion O.I.55* (K); Arusha Distr., road on northern side of Mt Meru, 26.12.1968, *Richards 23478* (K) 43E; *ibid.*, 29.12.1968, *Richards 23516* (K) 42E.

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Une nouvelle espèce du genre *Leptaulus* Bentham (*Icacinaceae*) à Madagascar

J.-F. VILLIERS

Résumé : *Leptaulus madagascariensis* J.-F. Villiers est décrit de Madagascar.

Summary : *Leptaulus madagascariensis* J.-F. Villiers is described from Madagascar.

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Le genre *Leptaulus* Bentham regroupe 5 espèces en Afrique tropicale et à Madagascar où seul *Leptaulus citrioides* Baillon est connu actuellement. Une récolte faite dans le Sud de cette île permet de décrire un nouveau taxon.

***Leptaulus madagascariensis* J.-F. Villiers, sp. nov.**

Arbor vel arbuscula (?). *Rami glabri. Folia alterna sine stipulis. Petiolus glaber. Lamina glabra coriacea, anguste elliptica vel elliptica, cuneiformis subrotundata ad basim, ± acuminata ad summum. Inflorescentia lateralis vel sublateralis. Flos hermaphroditus, pentamerus. Sepala imbricata glabra, ciliata ad marginem. Petala solidanta, glabra; lobus cum eminentia interna carnosia ad summum et villo carnosio interno ad basim. Anthera cum connectivo sine appendiculo. Ovarium pubescens, uniloculare, cum duobus ovulis pendentibus, cum duobus obtusis aculeis ad summum; stylus excentris. Drupa glabra, ellipsoidea, uniseminalis.*

TYPE : Debray 2014, Madagascar, N Fort Dauphin, Sud Massif Tsingafiafy, fl., fr., 4.III.1973 (holo-, P; iso-, P).

Arbre ou arbuste (?). Rameaux glabres. Feuilles alternes non stipulées. Pétiole glabre long de 4-9 mm, face supérieure fortement canaliculée. Limbe glabre sur les deux faces, coriace, vert sombre à jaunâtre luisant dessus et vert pâle mat dessous sur le sec, étroitement elliptique à elliptique, 3-11 × 1,2-3,5 cm, base cunéiforme à atténuée subarrondie, sommet généralement plus ou moins acuminé obtus, rarement obtus. Nervure médiane glabre sur les deux faces, concave dessus et saillante dessous. Nervures secondaires 4-8 paires, légèrement alternes, ascendantes, arquées, s'anastomosant loin du bord du limbe, saillantes dessus et très saillantes dessous. Reste de la nervation peu dense, obscurément à faiblement saillant dessus et plus ou moins saillant dessous.